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Major Petroleum Facility and Central Steam Facility

Facility Environmental Monitoring Report

Calendar Year 2003

BROOKHAVEN NATIONAL LABORATORY

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Prepared by
D. Paquette, J. Williams, R. Lee, and M. Allocco
Environmental and Waste Management Services Division

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Summary of Results

Analysis of environmental samples collected at the Major Petroleum Facility and Central Steam Facility during 2003 indicates that current operations are not impacting air or groundwater quality.

No fuel-related chemicals were detected in the groundwater at the Major Petroleum Facility. However, as in 2002, the chemicals tetrachloroethylene and 1,2-dichloroethene were detected in one well at concentrations exceeding New York State water quality standards. These contaminants are not associated with current operations and probably originate from historical solvent spills near the Central Steam Facility.

Continuous emission monitoring data and No. 6 fuel oil analytical sample results collected during 2003 confirm that the four boilers at the Central Steam Facility were fully compliant with applicable nitrogen oxide (NO_x) emission standards and with NYSDEC operating permits. All but one of the periodic exceedances of the opacity standard, measured by the continuous opacity monitor for Boiler 7, occurred during monitoring system calibrations, boiler start-ups, and routine boiler maintenance intervals. A deviation from the requirements of Condition 43.5 of the BNL Title V permit occurred during the interval of March 10th to March 23rd, when 56,634 gallons of distillate oil was burned in Boiler 1A. This operation was part of a burn-off of more than 436,000 gallons of distillate oil that was stored in Major Petroleum Facility storage tanks 5, 6 and 12. The burn-off of the distillate oil was necessary so that the tanks would be empty prior to scheduled inspections and leak tests needed to satisfy requirements of Article 12 of the Suffolk County Sanitary Code. Distillate oil is generally used in Boiler 1A only for emergency light-offs of the burners. Standard operating procedures for boiler start-ups have since been modified and instructions were given to steam plant personnel. BNL self-disclosed this permit deviation to the NYSDEC, and no fines or penalties were levied.

In 2003 the Laboratory prepared a draft remedial action plan for remediating lead contaminated soils at the Central Steam Facility storm water outfall. The plan was submitted to the regulatory agencies in April. The SCDHS was the only regulatory agency to comment on the proposed plan. Both the EPA and NYSDEC declined to review due to competing priorities. The SCDHS expressed concern over the proposed remedial objective of 1,200 ppm and requested further characterization. In July and September fieldwork was performed under the observation of the SCDHS. The results of the fieldwork validated the original extent of contamination. Based upon County concerns the cleanup objective was reduced to 400 ppm, which is consistent with the NYS DEC and EPA cleanup standard for residential soils. The remedial action plan was revised to include the results of the 2003 fieldwork and the revised cleanup objective. The plan was resubmitted to the regulatory agencies for review in March 2004.

Background

The Major Petroleum Facility (MPF) is the holding area for fuels used at the Central Steam Facility (CSF). Fuel oil for the CSF is held in a network of seven aboveground storage tanks. The tanks, which have a combined capacity to contain up to 1.7 million gallons of #6 fuel oil and 660,000 gallons of #2 fuel oil, are connected to the CSF by aboveground pipelines that have secondary containment and leak detection devises. All fuel storage tanks are located in bermed containment areas that have a capacity to hold >110 percent of the volume of the largest tank located within each bermed area. The bermed areas have bentonite clay liners consisting of either Environmat (bentonite clay sandwiched between geotextile material) or bentonite clay mixed into the native soils to form an impervious soil/clay layer. As of December 1996, all fuel unloading operations were consolidated in one centralized building that has secondary containment features. The MPF is operated under New York State Department of Environmental Conservation (NYSDEC) license #1-1700. As required by law, a Spill Prevention Control and Countermeasures Plan and a Facility Response Plan have been developed for the facility (BNL, 2000; BNL, 2002b).

The CSF uses four boilers to supply steam for heating and cooling to major BNL facilities through an underground steam distribution and condensate grid. To control emissions of nitrogen oxides (NO_x), a pollutant that contributes to the formation of ozone in the lower atmosphere, both US EPA and NYSDEC have enacted regulatory requirements that restrict NOx emissions from large and midsize boilers. The CSF uses a combination of engineering and administrative controls to comply with applicable NOx emission standards.

For Boilers Nos. 1A and 5, compliance with the NOx emission standard of 6 NYCRR Part 227-2 is achieved through the use of low-excess air burners. Initial compliance with this standard was demonstrated through stack testing conducted in January 1995 while each boiler burned No. 6 oil with fuel nitrogen and sulfur contents of less than 0.3 percent. To help to ensure compliance with the NO_x limits, all CSF contracts with No. 6 oil suppliers specify that No. 6 oil delivered to the MPF have a nitrogen content not greater than 0.3 percent by weight.

In addition to the emission limits of 6 NYCRR Part 227-2, Boiler Nos. 6 and 7 must comply with NO_x emission limits of New Source Performance Standard, 40 CFR 60 Subpart Db. Boiler No. 7 must also comply with 40 CFR 60 Subpart Db, stack opacity monitoring requirements. Both boilers use dual fired low NO_x burners to meet the emission standards. To demonstrate initial compliance with the Subpart Db standard, stack tests were conducted on Boilers 6 and 7 in October 1991 and May 1996 respectively. In accordance with Subpart Db requirements, NO_x continuous emission monitors are used on both boilers and a continuous opacity monitoring system is used on Boiler 7 to ensure continuous compliance with the NO_x and opacity standards.

Environmental Monitoring Program

BNL has established air, groundwater, and stormwater discharge monitoring programs at the CSF and MPF to evaluate potential impacts to environmental quality and to demonstrate compliance with DOE requirements and applicable federal, state, and local laws, regulations, and permits. Monitoring requirements are described in the NYSDEC License and summarized in the *BNL Environmental Monitoring Plan* (BNL, 2003).

Monitoring Results

Air

The primary objective of air monitoring efforts at the CSF is to verify compliance with applicable federal and state NO_x emission and opacity standards. This is accomplished either through periodic monitoring of residual fuel deliveries to the MPF, surveillance monitoring of visible stack emissions from Boilers 1A, 5 and 6, or continuous monitoring of NO_x and opacity emissions through monitoring ports in stacks for Boilers 6 and 7. Monitoring results were provided to NYSDEC on a quarterly basis (Goode, 2003a; Goode, 2003c; Goode, 2003d; Goode, 2004)

Since there are no continuous emissions monitoring requirements for Boilers 1A and 5, the CSF uses the measured nitrogen content from composite samples of No. 6 fuel deliveries to the MPF during the quarter as a surrogate indicator for compliance with NO_x emission standards. Continued compliance with the emission standard is presumed so long as laboratory analysis of composite residual fuel samples confirms the fuel nitrogen content does not exceed 0.3 percent by weight. Analysis of composite samples of residual fuel oil deliveries to MPF storage tanks during each quarter of CY 2003 confirmed that the fuel bound nitrogen content of No. 6 oil burned at the CSF was less than 0.3 percent by weight.

While there are no regulatory requirements for continuous monitoring of opacity for Boilers 1A, 5, and 6, surveillance monitoring of visible stack emissions is conducted daily by CSF personnel. During 2003, there were several instances when this daily check was not conducted. Daily observations of stack gases recorded throughout the year in accordance with conditions of BNL's Title V operating permit showed no visible emissions with opacity levels exceeding regulatory limits established for these boilers.

From May 1 to September 15 (the peak ozone period), compliance of Boilers 6 and 7 with the NO_x emissions limits was demonstrated by calculating the 24-hour average emission rate from continuous emission monitor readings, and comparing this value to the emission standards (0.30 lbs/MMBtu for oil and 0.20 lbs/MMBtu for gas). For the remainder of the year, the calculated 30-day rolling average emissions rate was used to establish compliance. In CY 2003, there were no measured exceedances of the NO_x emission standard for either boiler. For the year, NOx emissions from Boiler 6 averaged 0.252 lbs/MMBtu when No. 6 oil was burned, and 0.158 lbs/MMBtu when No. 2 oil was burned, and 0.152 lbs/MMBtu for natural gas. Similarly, the annual average NO_x emissions recorded by the continuous emission monitors on Boiler 7 when No. 6 oil, No.

2 oil, and natural gas were burned were 0.201 lbs/MMBtu, 0.183 lbs/MMBtu, and 0.080 lbs/MMBtu, respectively.

Boiler 7 flue gas opacity is measured by a transmissometer mounted on the stack above the CSF roofline. Opacity readings are taken at 15-second intervals and reported as 6-minute averages. Measured opacity levels cannot exceed 20 percent opacity, except for one 6-minute period per hour of not more than 27 percent opacity. Twenty-five, six-minute intervals of excess opacity were recorded during a two week period that followed a February 18th storm that dropped nearly two feet of snow. Winds after the storm caused snow to block a blower filter, thereby reducing airflow across a mechanical flapper. The reduced airflow allowed the flapper to drop into the optical path, attenuating the transmissometer signal and causing the erroneous opacity readings. All of the remaining excess opacity measurements recorded for the year, with the exception of one unexplained six-minute period observed on March 28th, occurred during opacity monitoring system calibrations, boiler start-ups, or during routine boiler tube soot blowing operations.

Permit Deviation Related to Distillate Oil Burn-off: Condition 43.5 of BNL's Title V Permit authorizes the combustion of distillate oil in Boiler 1A, only after stack testing can demonstrate that the boiler can meet the NOx emission limit of 0.12 lbs/MMBtu established by 6 NYCRR 227-2.4(c)(2). To meet this limit, Boiler 1A would have to employ combustion controls such as the use of low excess air, over-fire air, or low NOx burners. Over a two week period, from March 10th to March 23rd, 56,634 gallons of distillate oil was burned in Boiler 1A, in effect violating this permit condition. This was part of a burn-off of more than 436,000 gallons of distillate oil that was stored in three above ground storage tanks (Tanks 5, 6 and 12) at the Major Petroleum Facility. The burn-off of distillate oil was necessary so that the tanks would be empty prior to scheduled inspections and leak tests of the tanks to satisfy requirements of Article 12 of the Suffolk County Sanitary Code. The burn-off of distillate oil in Boiler 1A was an oversight by steam plant staff. Distillate oil is generally used in Boiler 1A only for emergency light-offs of the burners. Standard operating procedures for boiler start-ups have since been modified and instructions were given to steam plant personnel to ensure that distillate oil is only used in Boiler 1A for emergency light-offs of burners. BNL self-disclosed this permit deviation to the NYSDEC, and no fines or penalties were levied.

Groundwater

The MPF's groundwater monitoring program is designed to confirm that the engineered and institutional controls are effective in preventing contamination of the aquifer. During 2003, groundwater quality in the MPF area was monitored using eight wells (076-16, 076-17, 076-18, 076-19, 076-25, 076-378, 076-379, and 076-380). The locations of the monitoring wells are shown on Figure 1.

Groundwater contaminants from the fuel oil products stored at the MPF can travel both as free product and in dissolved form with advective groundwater flow. Historically, the Special License Conditions for the MPF required the groundwater monitoring program to

include semiannual sampling for semivolatile organic compounds (SVOCs) and monthly monitoring for floating petroleum. In early 2002, NYSDEC expanded the required analysis list for the MPF wells to include volatile organic compounds (VOCs). Prior to 2002, BNL had periodically tested the MPF wells for VOCs because of historical solvent and fuel spills that had occurred in the area.

BNL sampled the MPF wells in April and October 2003. The samples were tested for SVOCs and VOCs. As in the past, no SVOCs were detected, and no floating product was observed (Goode, 2003b; Goode, 2003e). However, VOCs continued to be detected in several wells at concentrations exceeding the New York State Ambient Water Quality Standard of 5 ug/L (or 5 parts per billion). 1,1,1-trichloroethane (TCA) was detected in upgradient well 076-25 at a concentration of 15 ug/L. Low levels of TCA have been detected in this well for many years, and it probably originates from a solvent spill area near Building 650. (Note: Solvent spill areas on the north side of Building 650 were evaluated during the Operable Unit IV Remedial Investigation.) Degreasing solvents continued to be detected in downgradient well 076-380, but at lower concentrations compared to 2002 (Figure 2). 1,2-dichloroethene *(total)* was detected at a concentration of 22 ug/L, tetrachloroethene at 38 ug/L, and trichloroethylene at 7.3 ug/L. (Note that 1,2-dichloroethene is a breakdown product of the common degreasing agent tetrachloroethylene.)

Following the 2002 detection of 1,2-DCE in well 076-380 (up to 566 ug/L), BNL implemented the Groundwater Protection Contingency Plan, which included confirmatory sampling, increased sampling frequency, regulatory agency notifications, evaluation of available records on solvent use at the CSF, groundwater modeling, and plans for the installation of temporary monitoring wells (see BNL, 2003b). In early 2003 BNL installed four temporary Geoprobe wells, with three wells located downgradient of the suspected source areas near Building 610 (Figure 3). Only downgradient Geoprobe well MPF-GP-03 had detectable levels of VOCs, with PCE at a concentration of 6.6 ug/L and cis-1,2-DCE at a concentration of 14.5 ug/L. Although MPF-GP-03 was located downgradient of the former “oil tank valve house,” a source closer to Building 610 cannot be ruled out. The historical nature of this spill is supported by: 1) degreasing agents such as tetrachloroethene have not been used at the CSF in many years; 2) tetrachloroethene has been detected in well 076-19 since the early 1990s; and 3) the presence of 1,2-dichloroethene, which is a breakdown product of tetrachloroethylene. A number of historical spill sites near the CSF were identified in the late 1990s, and the most contaminated soils were subsequently excavated in accordance with regulatory requirements.

SPDES Monitoring

Storm water from the MPF/CSF area is discharged to an outfall located approximately 900 feet east of Bldg. 610. This discharge is regulated under the BNL State Pollutant Discharge Elimination System (SPDES) permit, Outfall 010. This discharge point receives stormwater runoff from the area around the CSF, North 6th Street east of the CSF, and Cornell Avenue north of the CSF. Historical surveillance monitoring of the

discharge revealed sporadic detections of lead above the NYS groundwater discharge standard of 50 ug/L. In 2000/2001, an area of lead contaminated soils was discovered at the outfall. Resuspension of the contaminated soils at the outfall during sample collection was identified as the probable cause for the periodic discharge violations. In February 2002, NYSDEC added lead monitoring as a condition of the BNL SPDES permit for this outfall. During 2002, the effluent standard for lead was exceeded on two occasions. Evaluation of the effluent sample collection process indicated that re-suspended contaminated soils might have been entrained in the samples during collection, resulting in erroneously high lead concentrations. To mitigate this sampling effect, a geotextile was installed at the outfall to prevent resuspension of contaminated soils. Based on subsequent effluent analyses, the textile has been successful in preventing the resuspension of contaminated soils, and has allowed for the collection of more representative effluent samples. There were no SPDES violations for lead during 2003. There was however, a single excursion for aluminum that was attributed to native sediment carryover in storm water runoff. Since particulate sediment does not pose a threat to groundwater, the NYSDEC approved a SPDES permit modification to allow filtration of samples prior to acid preservation.

In 2003, an additional field investigation was conducted in response to concerns expressed by the SCDHS to verify the extent of lead contamination. This activity included collection of additional soil samples in areas previously characterized with single point samples. Due to an obvious flow channel, additional soil samples were not originally conducted. Sampling of soils within five feet of the original sample location showed all levels to be less than 400 ppm, which confirmed the original assumption that the contaminated soils did not extend far from the original sample point. The SCDHS also requested that the clean-up objective be lowered from 1,200 ppm to 400 ppm. The original objective was based upon a residential soil standard documented in Part 703 of the Toxic Substances Control Act. Based upon County concern the objective was lowered to 400 ppm, which is the EPA and NYSDEC recognized cleanup standard for residential soils. The extent of soil contamination that requires cleanup is shown in Figure 4. The results from the supplemental investigation and the revised cleanup objective were documented in a revised remedial plan that was submitted to the regulatory agencies for review in March 2004.

During the mid 1970s through the early 1990s, the Laboratory participated in an alternate liquid fuels (ALF) program. This program consisted of purchasing various types of fuel or other combustible liquids from governmental agencies and the private sector. These fuels were stored and mixed with residual fuel and burned at the CSF. The fuels were composed of waste oils, jet fuel, and waste organic solvents. A review of available documentation for the ALF program shows that the fuel had lead concentrations up to 300 ppm. The fuels were blended with virgin No. 6 fuel oil in quantities to produce a product similar in characteristics to No. 4 fuel. Due to the waste nature of some of the ALF products, ash/slag buildup in the boilers was heavier than normal and required frequent removal via water washing. All wastewater generated by this process was discharged to the CSF floor drains. Until the early 1980’s, the floor drains discharged to the stormwater collection system. The floor drains were subsequently redirected to the

BNL sanitary sewer. This wastewater most likely contained elevated metals, due to the high levels contained in the waste oils. Elevated levels of vanadium detected in soil samples collected at the headwall are indicative of a fuel-based source, which further supports the supposition that the boiler wash water is the most likely source of the lead and other inorganic contaminants.

Future Monitoring Actions

The following actions are recommended for CY 2004:

- Maintain the groundwater monitoring program on its current semiannual schedule in accordance with NYSDEC requirements.
- Maintain the air monitoring program on its current schedule as required by the NYSDEC license. To ensure that visible emissions monitoring is conducted daily, the CSF Supervisor will review EP Procedure No. O&M-CSF-018 with all Senior Stationary Engineers and remind them of their responsibilities for making daily observations of visible emissions from Boilers 1A, 5 and 6.
- Continue SPDES and Environmental Surveillance monitoring.

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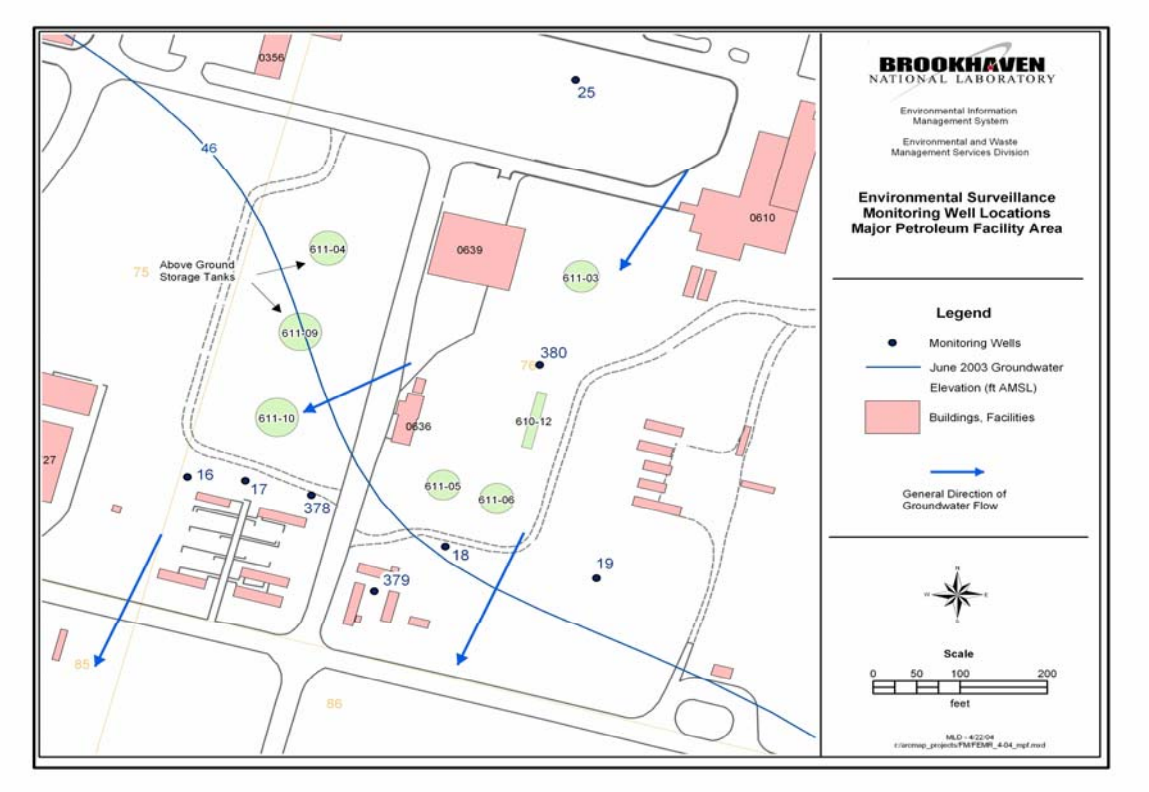

Figure 1. Locations of BNL Groundwater Monitoring Wells at the MPF.

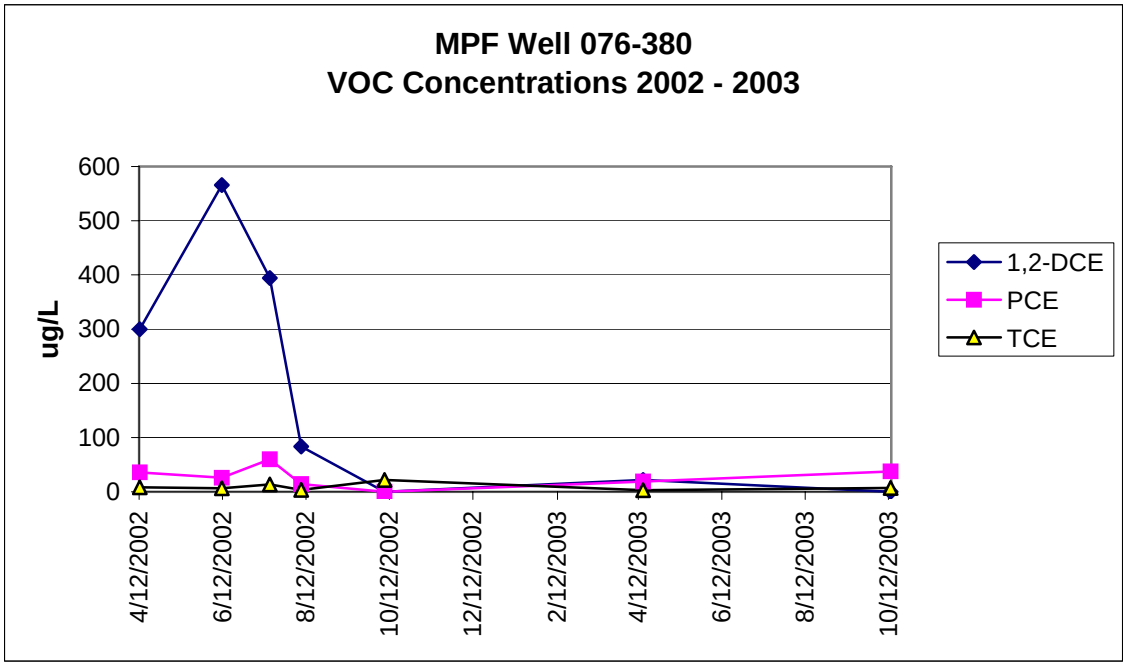

Figure 2: Trend of VOC Concentrations in MPF Well 076-380 during 2002 - 2003.

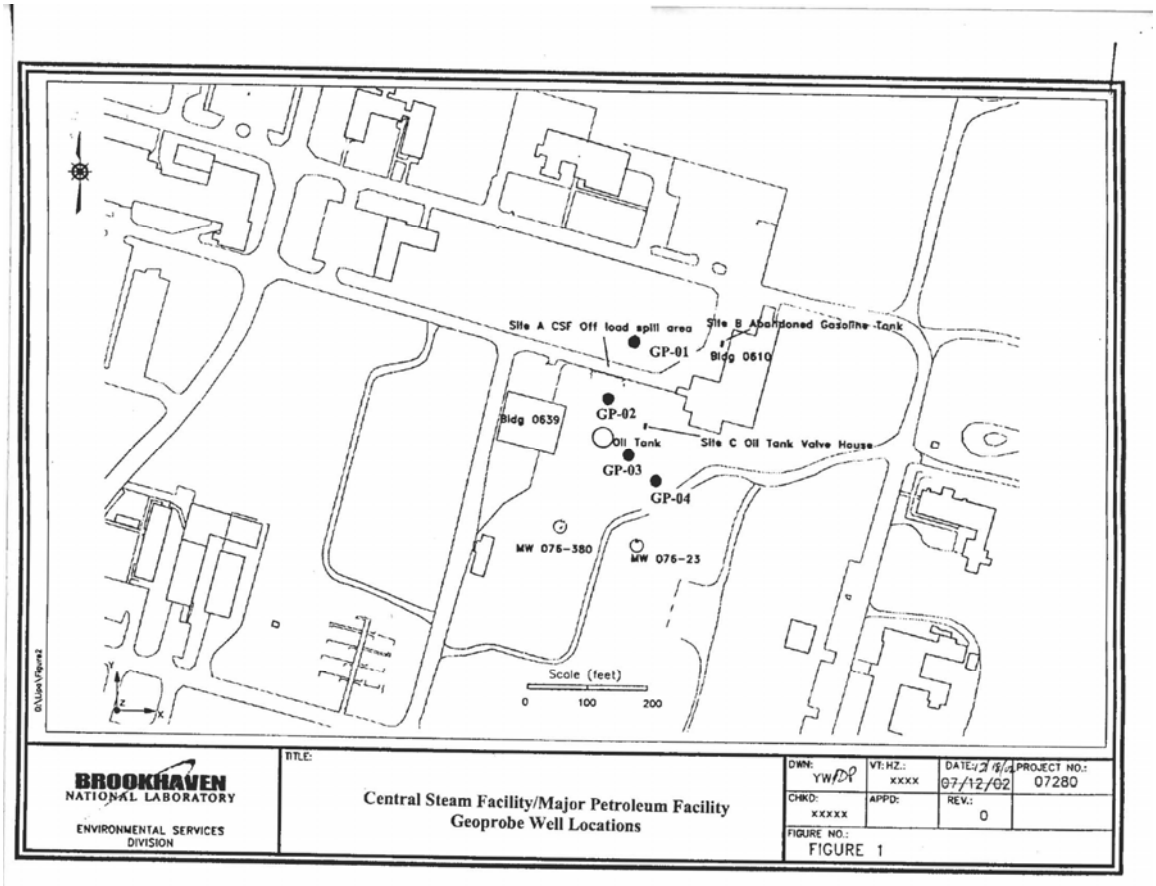

Figure 3: Locations of Geoprobe wells installed in 2003.

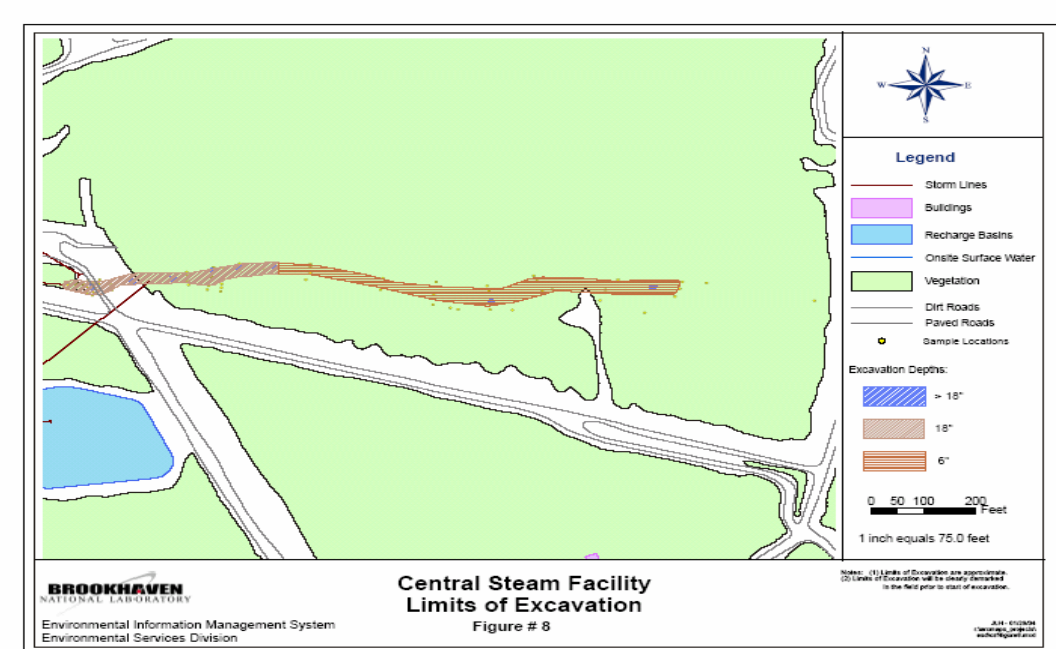

Figure 4 : Extent of lead contaminated soils requiring cleanup at the CSF storm water outfall.